

# Laparoscopic Donor Nephrectomy in Hawaii

Racquel Bueno MD, Whitney Limm MD, Alan Cheung MD, and Linda Wong MD

## Abstract

Laparoscopic donor nephrectomy for transplant is a minimally invasive, effective, and safe operation that also provides less post-operative pain and earlier return to pre-donation activity. In review of the first 10 cases, no major complications occurred and mean hospital stay was 3.7 days. All recipients of these kidneys displayed excellent allograft function (mean creatinine - 1.5 mg/dL) and no ureteral problems. Successful use of this procedure has also resulted in a steady increase in the number of living transplants performed in Hawaii and perhaps this will impact the 330 patients currently awaiting renal transplant.

## Introduction

End-stage renal disease (ESRD) continues to be a major health problem and a significant financial burden in the US. In 1998, 397,971 people had ESRD.<sup>1</sup> The total number of ESRD patients continues to grow at a rate of about 10% per year.<sup>2</sup> Caring for ESRD costs the US about \$15 billion annually.<sup>1</sup> As a state, Hawaii has the second highest incidence of ESRD at 20 per 100,000 in 1996 and currently about 2100 patients are on some type of dialysis.<sup>3</sup>

Renal transplant is considered the treatment of choice for selected patients with ESRD, but limited donor supply has been a major factor in preventing its widespread use. Patients receiving a kidney from a living donor benefit from improved allograft function and survival, reduced length of time on dialysis and less rejection compared to cadaveric kidneys. Unfortunately, only 1.3% of the ESRD population in the US have undergone living donor kidney transplantation.<sup>4</sup> Thirty percent of all transplanted kidneys are from live donors, while 70% are cadaveric transplants.<sup>5</sup> Underutilization of this precious resource translates into longer waiting periods on the cadaveric list (median > 2 years).<sup>6</sup> While waiting, ESRD patients experience the ongoing effects of their progressive disease and often die before a suitable organ becomes available.

On the other hand, potential living donors need to weigh their altruism against the consequences of having an operation. Major concerns include future health problems, postoperative pain, returning to pre-donation activity, and the financial burden in terms of hospital costs and the time lost from productivity. The advent of the laparoscopic donor nephrectomy in 1995 provided an equally effective and less invasive procedure.<sup>7</sup>

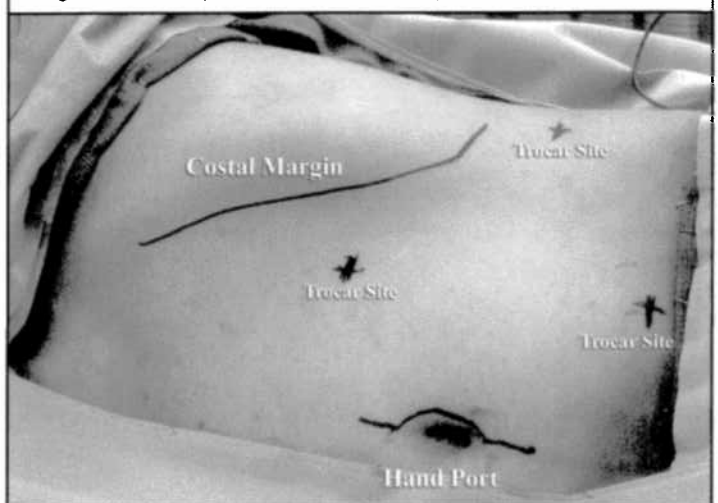
Many transplant centers offering the laparoscopic approach have noted significant increases in the number of living donors as well as an increase in the number of unrelated living donors.<sup>4</sup> The Transplant Center at St. Francis Medical Center began offering laparoscopic live donor nephrectomies in December 2000. The aim of the study was to review our early experience and its impact on live transplants in Hawaii.

## Methods

Between December 20, 2000 and August 15, 2001, 10 consecutive laparoscopic donor nephrectomies were performed at St. Francis Medical Center, Liliha. All living donors underwent hand-assisted, laparoscopic left sided nephrectomy using the transperitoneal approach. Donors were admitted on the evening prior to surgery for aggressive fluid hydration. With the donor in the right lateral decubitus position, a 6 – 7 cm peri-umbilical midline incision was used for the hand port. The Dexterity Pneumo-Sleeve® was used for all procedures. Pneumoperitoneum was established with CO<sub>2</sub> to an intra-abdominal pressure of 14 mm Hg. In addition to using the hand port, three additional instrument trocar ports were required.

Mobilization of the left colon medially by incising the lateral peritoneal reflection allowed access to the left kidney. The gonadal vein, adrenal vein, renal vein/artery and ureter were identified and isolated. Care was taken to avoid devascularizing the ureter by dissecting it medial to the left gonadal vein. The ureter, renal artery and vein were then transected with the assistance of clips and endovascular staplers. Once removed, all donor kidneys were placed on ice and flushed with 500 cc Euro-Collins solution.

Figure 1.— Intraoperative Trocar/incision placement



Correspondence to:  
Linda L. Wong, MD  
2226 Liliha Street, Suite 402  
Honolulu, Hawaii 96817  
Fax: (808)-528-4940  
Email: [Hepatoma@aol.com](mailto:Hepatoma@aol.com)

Kidneys were then transported to the adjoining operating room for immediate transplant into the recipient within about 30 minutes from removal.

We retrospectively reviewed medical records of the donors and recipients involved in these transplants. Data collected included donor demographics (age, sex, race), relationship to recipient, operative time, length of stay, serum creatinine (pre-operative and discharge) and complications. For recipients, we looked at demographics, etiology of end stage renal disease, length of time on hemodialysis, creatinine (pre-operative, discharge, 1 and 3 months post-operative), complications, and length of hospital stay.

We also reviewed the number of patients added annually to the cadaveric renal transplant list from 1997 to 2000. The number of living related or unrelated transplants were also noted from 1997 to 2001 to see if there was any increase in renal transplant since addition of the laparoscopic procedure.

## Results

Mean donor age was 40.4 years (range 26 to 54) and mean recipient age was 49.9 years (range 34 to 66). Male: Female ratio was 4:6 in both donors and recipients. (Figure 2)

The majority of patients did not have extended hemodialysis times prior to transplantation: 5/10 recipients had ESRD but were pre-hemodialysis; 4/10 were on hemodialysis for < 7 months; one patient spent an extended period on hemodialysis (4 years, 3 months).

The donor-recipient relationships among the laparoscopic donor nephrectomies during this time period are as follows: 3 related (2 child to parent, 1 sibling) and 7 unrelated (5- spouse; 2- friend). The majority of recipients shared at least one HLA antigen with their respective donors: 4/10 shared 3 HLA antigens; 4/10 shared 1 HLA antigen; 2/10 were unmatched.

Mean operative time for the donor procedure was 5 hours and 15 minutes (range 4 – 6 hours). There were no intra-operative complications and no patient needed blood transfusion. No conversions to the traditional open procedure were required.

With regards to donor renal function, mean serum creatinine was 0.88 mg/dL preoperatively and 1.28 mg/dL postoperatively. One of the 10 donors had transient elevation of his post-operative creatinine

to 2.1 mg/dL from a preoperative level of 1.4 mg/dL. With more aggressive intravenous hydration, creatinine decreased to 1.9 mg/dL. This did not extend his hospital length of stay. There were no postoperative complications. The average length of stay among the donors was 3.7 days (range 3-4 days) following the procedure.

All transplanted kidneys functioned immediately in the post-operative period. Two kidneys required ex-vivo reconstruction of multiple renal arteries. No patient needed post-operative dialysis. Acute tubular necrosis and ureteral problems were not observed in any patient. Mean serum creatinine decreased from 6.98 mg/dL preoperatively to 1.28 mg/dL at discharge, 1.32 mg/dL (n=9) at one month, and 1.50 mg/dL (n=7) at three months post-transplant

One recipient experienced an early rejection episode documented by open renal biopsy. This rejection episode responded to high dose steroids and she currently has excellent allograft function (3 month creatinine of 1.3 mg/dL). Another patient developed a small wound seroma that was managed with local wound care and close outpatient follow-up. Among the recipients, mean length of stay was 6.7 days (range 6 – 10 days).

From 1997 to 1999, 64-66 new patients were added to the cadaveric renal transplant list annually. In the last 2 years, over 100 new patients were added to the list for each year. As of September 1, 2001, a total of 330 patients are waiting for cadaveric kidneys. During this time period, 28-60 renal transplants were performed annually. While the number of living renal transplants performed has been somewhat variable, there has been a steady increase in the number of living unrelated transplants performed. Up until August 2001, 7 such living unrelated kidney transplants have already been performed for the year.

## Discussion

The number of patients suffering from ESRD and the number of patients on the transplant list here in Hawaii, as throughout the rest of the US, continues to climb. As of September 2001, more than 78,000 patients are on the waiting list for cadaveric organ transplants. Nearly 50,000 of these patients are waiting for kidneys.<sup>8</sup> A kidney transplant, ideally from a living donor, is the therapeutic intervention of choice for selected patients with ESRD. The benefits of receiving an organ from a living donor include immediate graft

Figure 2.— Recipient data (HD = hemodialysis, LOS = length of stay in days, ATN- acute tubular necrosis, DC = discharge, Cr = creatinine in mg/dL, mo = months)

Recipient	Age	Sex	HD Time	LOS	ATN	Pre-Op Cr	DC Cr	1 mo Cr	3 mo Cr	Rejection	Complications
1	45	F	7 mo	7	no	8.8	0.7	0.9	1.4	no	
2	53	M	Pre HD	6	no	5.7	1.7	1.9	2.1	no	
3	53	F	Pre HD	6	no	4.9	0.8	0.8	0.9	no	no
4	66	M	4 mo	6	no	6.3	1.4	1.2	1.8	no	no
5	51	M	Pre HD	6	no	4.7	1.3	1.5	1.6	no	no
6	42	F	4 mo	10	no	6.4	2.2	1.3	1.1	yes	open renal bx
7	42	M	Pre HD	7	no	8.3	1.4	1.6	1.6	no	no
8	63	M	Pre HD	6	no	7.2	1	1.3		no	no
9	50	M	1 mo	7	no	8.1	1.3	1.4		no	wound seroma
10	34	F	51 mo	6	no	9.4	1			no	no

function, improved graft survival, and less time on dialysis. Unfortunately, the numbers of donors, cadaveric or living, are not increasing sufficiently enough to meet such a demand. Because the number of cadaveric donors has not increased significantly in the past decade, patients are waiting longer and are dying while waiting. With the relatively fixed cadaveric rate, we can only hope to increase the number of donors by increasing the number of living donor volunteers.

Transplant professionals are doing everything possible to confront this problem. Researchers are attempting to grow organs from stem cells, transplant between species (xenotransplant), and develop new immunosuppressive drugs to eliminate rejection and minimize side effects. Organ procurement organizations continue efforts to promote organ donation in hopes of transplanting as many organs from as many suitable donors as possible. Transplant surgeons are expanding criteria for cadaveric donors, using non-heart beating donors, splitting cadaveric livers for two patients each, and transplanting pancreatic islet cells. Clearly one of the most important ways of decreasing the number of waiting patients is the use of living donors.

Living donor volunteers are limited in supply because of significant concerns about the effect of kidney donation on future health problems, risk of death, postoperative pain, returning to pre-donation activity, scarring and the financial burden in terms of hospital costs and the time lost from productivity. Laparoscopic donor nephrectomy can reduce these disincentives. With the laparoscopic approach, the negative impact on the donor's future health is minimized, there is less post-operative pain, less analgesic usage, decreased hospital stay, improved cosmesis, and earlier return to pre-donation activities. The patients are able to return to a functional and productive life much sooner than the traditional open method. Overall, the cost to the donor and to society is decreased.

Review of the current experience with the laparoscopic donor nephrectomy at the larger transplant centers have shown that it is comparable to the standard open technique in terms of both donor safety and allograft function.<sup>9</sup> With the reports of their earlier experiences, our center was able to lessen the negative effects of the steep learning curve associated with the laparoscopic approach. Technical modifications such as use of the hand-assist port makes

the procedure less technically challenging. Additionally, avoiding use of the right kidney with its shorter arterial and venous lengths also allowed for a safer procedure for donors and improved graft function for recipients. The ureteral stenosis and urinary leaks noted in the early experience was basically prevented with the increased awareness to keep all dissection medial to the gonadal vein/ureteral bundle.

The recipients displayed excellent allograft function with mean creatinine of 1.5 mg/dL at three months follow-up. None of the recipients experienced allograft ureteral problems. No donor experienced post-operative complications except for a transient increase in creatinine. Otherwise, the post-operative course in all of the donors was uncomplicated. Most of the donors were discharged within 3-4 days (average 3.7 days).

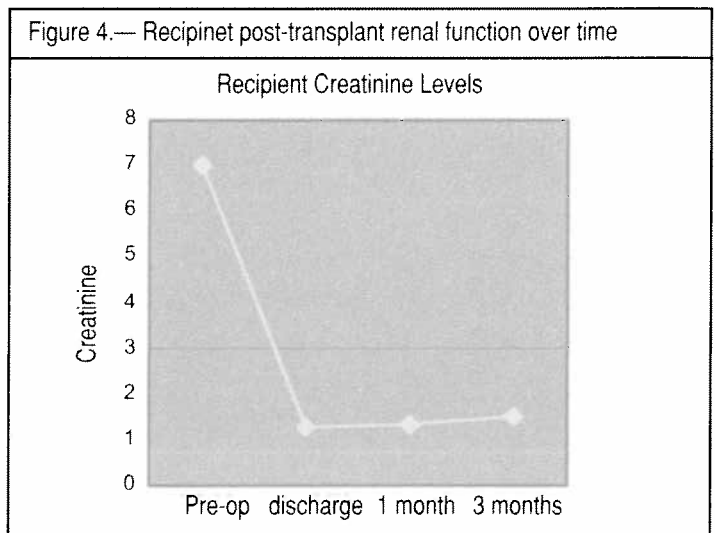
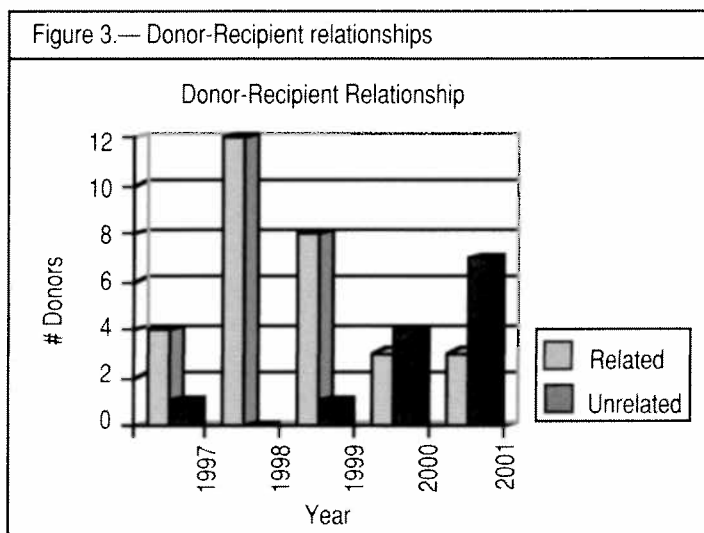
Living kidney donation using the laparoscopic approach not only offers the recipients excellent allograft function, but also provides a less invasive and more benign procedure for living donor volunteers. By allaying the anxiety associated with living donation, laparoscopic donor nephrectomy quite possibly may be expanding the living donor pool. Several center offering this approach have already noted impressive improvements in their living donor transplantation rate.<sup>4, 10, 11, 12</sup>

In conclusion, laparoscopic donor nephrectomy has truly emerged as one of the important techniques that not only minimizes pain and disability, but also increases living organ donation. This has been done successfully in Hawaii and we hope that living donation will continue to flourish and perhaps impact the 330 patients currently awaiting renal transplant.

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*Continued on p. 108*



### Mending Hearts...

Scientists from New York Medical College examined hearts from eight men who had been transplanted hearts from women donors and found that the female hearts contained male cells.

Piero Anversa, heart researcher and coauthor of the study called them "primitive stem cells," hopes the primitive cells can be mobilized to fix heart problems. "The fantasy is that they'll generate all the cell lineages that you have in the heart. The ultimate goal is to get the heart to heal itself."

### POTPOURRI

It was a stifling hot day and a man fainted in the middle of a busy intersection... Traffic quickly piled up in all directions and a woman rushed over to help him. As she knelt down to loosen his collar, a man emerged from the crowd, pushed her aside and said, "It's all right honey. I've had a course in first aid."

The woman stood up and watched as he took the ill man's pulse and prepared to administer artificial respiration.

At this point, she tapped him on the shoulder and said, "When you get to the point about calling the doctor, I'm already here."

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Kerri, a vet, was feeling ill and went to see Dr. West. He began to ask all the usual questions, symptoms, duration, and the like—when Kerri suddenly cut him off. "Hey, look, I'm a vet," she declared. "I don't need to ask my patients these kinds of questions. I can tell what's wrong just by looking at them—why can't you?"

The doctor just nodded in response, looked Kerri up and down, and wrote out a prescription. He handed it to her and said, "There you are. Now, of course, if that doesn't work, we'll have to put you down."

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The doctor took Dan into the room and said, "Dan, I have some good news and some bad news." "Oh, no... Give me the good news, I guess," Dan replied. "They're going to name a disease after you."

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A college physics professor was explaining a particularly complicated concept to his class when a pre-med student interrupted him...

*"Laparoscopic Donor..."*, Continued from p. 100

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